Crooked Creek Design/Build Report

Kosciusko County, Indiana

December 10, 2003

Prepared for:

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CROOKED CREEK DESIGN/BUILD REPORT
EXECUTIVE SUMMARY

This project addresses sediment and associated nutrient loading to Big Chapman Lake from Crooked Creek in Kosciusko County, Indiana. The primary goal of the project was to reduce sediment and nutrient loading from eroding streambanks on Crooked Creek and an unnamed tributary to Crooked Creek. To accomplish this goal, 1,530 linear feet of streambank was stabilized with biologs, cribwalls, soil encapsulated lifts, native plantings, check dams, and refuse removal. This project was made possible by the cooperation of landowners and Chapman Lakes Conservation Association. It was funded by the Indiana Department of Natural Resources Lake and River Enhancement (LARE) Program and the Chapman Lakes Foundation.

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Kosciusko County, Indiana

1.0 PROJECT DESCRIPTION AND PURPOSE

Crooked Creek is located east of Big Chapman Lake in central Kosciusko County, Indiana (Figure 1). Crooked Creek, Big Chapman Lake's main inlet, drains approximately 775 acres of primarily agricultural land with forest and forested wetland surrounding the project location. Fifty percent of the creek's watershed is mapped in potentially highly erodible soil units. Development of the land for agricultural use within the Crooked Creek Watershed has led to increased stream flows during major storm events. Streambank and channel erosion have occurred as a result of these increased stream flows. Additionally, old culverts and other debris have redirected stream flows into the streambanks causing further erosion (JFNew and Associates, 2003).

The Chapman Lakes Foundation received funding from the Indiana Department of Natural Resources Lake and River Enhancement (LARE) Program to design and construct a project to address the problems noted above. Specifically, the purpose of the project was to reduce the delivery of sediment and associated nutrients to Big Chapman Lake by stabilizing eroding streambanks and streambeds along an unnamed feeder tributary to Crooked Creek (Site Location 1) and Crooked Creek itself (Site Location 2). A combination of treatments including coir logs, cribwalls, soil encapsulated lifts, wing deflectors, check dams, native plantings, and refuse removal was used to accomplish streambank and streambed stabilization. Site plans and design details can be found in Appendix A. A table describing treatment type, length, and location can also be found in Appendix A. This report describes the project design and outlines the project's construction and maintenance schedules.

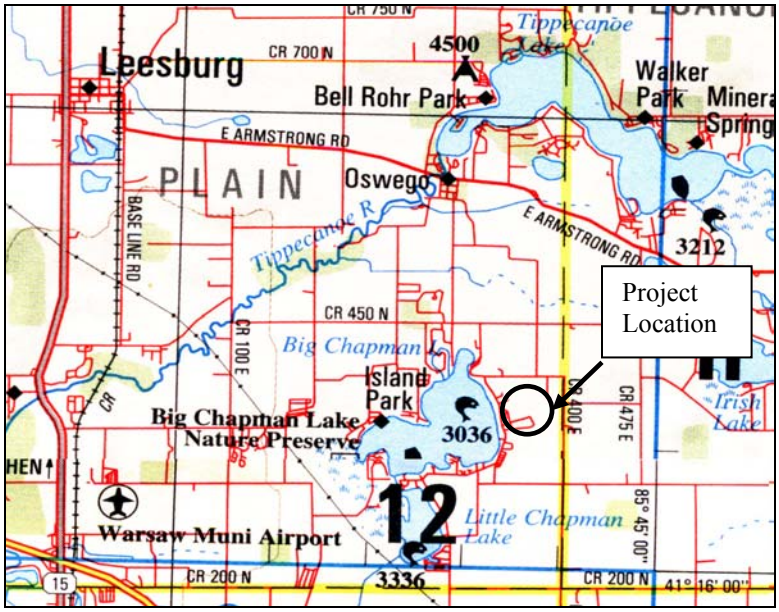


Figure 1. Crooked Creek general project location.

2.0 DESIGN RATIONALE

The project was designed to reduce excessive sediment and associated nutrient loading to Big Chapman Lake by stabilizing Crooked Creek's eroding streambanks. The design also provided an aesthetic alternative to riprap or other similar forms of unnatural streambank stabilization. This was an important consideration with future plans by Crooked Creek Development, L.L.C. to develop the site as a scenic, natural area for walking and nature watching. Additionally, the design provided further fishery and macroinvertebrate habitat along the stream margins.

3.0 DESIGN AND CONSTRUCTION SPECIFICS

3.1 Permitting

Permits were not required from the Indiana Department of Natural Resources (DNR) or the Kosciusko County Drainage Board. A DNR Construction within a Floodway Permit was not required for this project since the drainage area upstream of the project location was less than one square mile. A permit was not required from the Kosciusko County Drainage Board since Crooked Creek is not a legal drain. Section 401 Water Quality Certification from the Indiana Department of Environmental Management (IDEM) and a Section 404 Permit from the U.S. Army Corps of Engineers (USACOE) were required because Crooked Creek is considered a "water of the United States". Letters authorizing the work for the project from IDEM and USACOE are included in Appendix B.

3.2 Coir Logs

Approximately 230 feet of biolog was installed along Crooked Creek. Coir logs (Biologs) were installed along eroding streambanks where the distance from the top of the bank to the stream bottom was less than two feet. Coir logs were placed to follow the existing streambank's contour in most places (Figure 2). In areas where erosion had created scour holes in the streambank, coir logs were contoured to approximately follow the streambank prior to scour hole creation. After placement, coir logs were secured with oak stakes and nylon rope. Coir logs were then planted with a variety of native plant plugs. Once fully grown, the native plant roots will further stabilize the streambank after the coir logs have deteriorated. A planting list can be found in Appendix C.

Figure 2. Coir log installation.

3.3 Cribwalls

Approximately 1,090 feet of cribwall was installed along Crooked Creek and its tributary. Logs used for cribwall construction were obtained from trees on-site. Trees were either obtained from windfalls or from areas that were thinned to promote greater understory growth. Logs were cut to the appropriate length and placed by hand or with the assistance of a mini-excavator. Log diameter ranged from approximately 12 to 24 inches for base logs (logs located on face of the cribwall) and 4 to 6 inches for cross-logs (logs that tie the base logs to the streambank). Base logs were first installed then a series of cross logs were placed along its length. A series of pilot holes were created in each log with a power auger equipped with a drill bit. Three-foot rebar stakes were then driven through the log into the streambank or streambed with a sledgehammer. The number of rebar stakes used in each log depended on the log's length. The cribwall was built to the appropriate height by repeating this procedure (Figure 3). The void created behind the cribwall was filled with fieldstone by a skidster within several inches from the top base log. Soil was then placed over the rock and seeded with a native bank stabilization seed mix (Appendix C). Straw erosion control blankets were then stapled over the seeding area and placed between the gaps in the cribwall. Design details for cribwalls can be found in Appendix A.

Figure 3. Cribwall installation.

3.4 Soil Encapsulated Lifts

A total of 50 feet of soil-encapsulated lifts were installed on top of a cribwall along a high, eroded bluff. Soil encapsulated lifts were placed on top of the cribwall due to the mini-excavators inability to safely place logs at the height required to obtain streambank stability. Lifts were constructed by placing a 50-foot length of coconut erosion control blanket over a form then filling the area behind the form with soil. The lift was seeded with a bank stabilization seed mix, encapsulated with the blanket, and then stapled. The forms were removed and then placed on top of the lift to begin construction of the next lift (Figure 4). A total of three lifts were constructed in this manner. The total height for all three lifts and the cribwall was approximately five feet. Design details for soil encapsulated lifts can be found in Appendix A.

Figure 4. Installation of soil encapsulated lift on top of cribwall.

3.5 Wing Deflectors

Three wing deflectors were installed to increase habitat diversity within a 150-foot stream reach. Logs and fieldstone were used construct wing deflectors within the stream channel. Logs were held in place with rebar stakes, forming a "V". The void between the logs was filled with fieldstone. The apex of the wing deflector protruded towards the thalwag of the channel with the upstream and downstream logs forming an approximate 45° angle to the shoreline. Design details of wing deflectors can be found in Appendix A.

3.6 Check Dams

Five check dams were installed in the unnamed ephemeral tributary that drains into Crooked Creek from the north through a culvert (Site Location 1). Check dams were installed to prevent down cutting in the tributary. An excavator was used to excavate a key trench into the channel banks and bed. The key trench extended 2 feet into each channel bank and the channel bed. The key trench was then filled with fieldstone ranging from 7 to 36 inches in diameter. Check dams were constructed so that the downstream check dam's top elevation was at the same elevation as the base of the check dam located immediately upstream of it. Design details of check dams can be found in Appendix A.

3.7 Native Plantings

A custom seed mix was applied over areas disturbed by construction equipment, on soil-encapsulated lifts, and on top of cribwalls (Figure 5). Coir logs were planted with a variety of native plant plugs. A complete planting list can be found in Appendix C.

Figure 5. Native plantings along disturbed banks.

4.0 CONSTRUCTION SCHEDULE

Construction within the stream channel was originally anticipated to begin in February or March of 2003 dependent on the weather and permit approval. In anticipation of the February or March start date, logs were stockpiled near areas in which they would be needed. An early thaw saturated site conditions, preventing construction in late winter of 2003. Construction was further delayed in the spring and early summer to protect spawning fish populations in Crooked Creek. Construction began in July. Construction was completed in October.

5.0 MONITORING AND MAINTENANCE ACTIVITY

Native plant growth following seeding was rapid after construction began in July. The weather conditions proved ideal for establishing the fast growing cover species and stabilizing soils in disturbed areas. No damage was observed to any of the erosion control measures installed during this project following heavy rain events. However, monitoring should be conducted annually for the next three years. Emphasis should be placed on ascertaining the structural integrity of coir log, cribwall, and lift structures. Any collapses or washouts of these structures should be reported to the Chapman Lakes Foundation or to JFNew. Also, any areas that were planted to stabilize the shoreline should be monitored to ensure that the plantings have become well established. This includes plantings in coir logs. No scheduled maintenance is anticipated with this project unless there are structural failures due to catastrophic flood events. Maintenance on noted failures should occur during the following summer or when conditions allow.

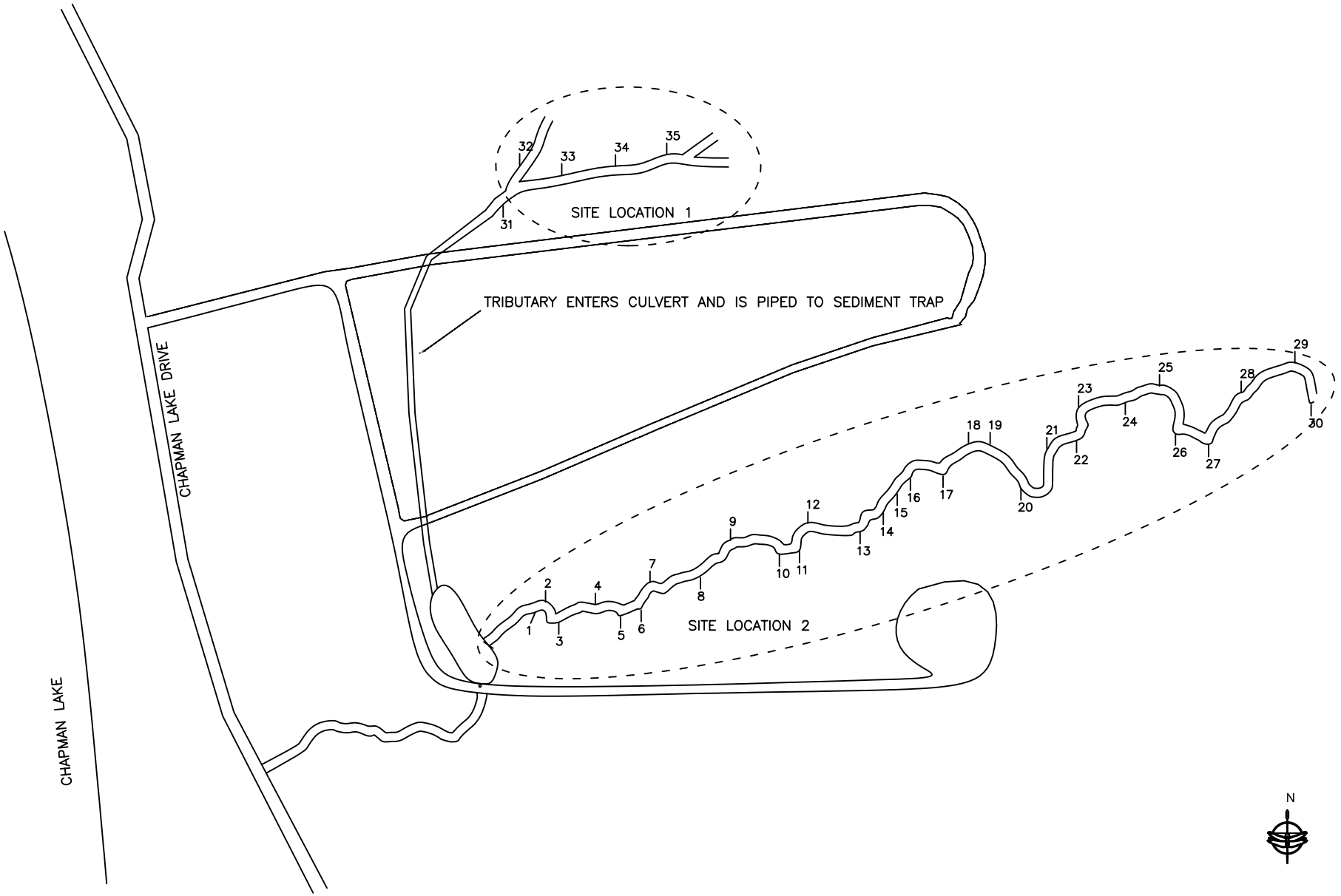
6.0 PROJECT SUMMARY

The overall purpose of this project was to reduce sediment and nutrient loading to Big Chapman Lake from Crooked Creek and its unnamed tributary. This goal was accomplished by stabilizing streambanks and streambeds with a combination of techniques including biolog and cribwall installation, construction of soil encapsulated lifts along high bluffs, native plantings along disturbed areas, installation of check dams in the unnamed tributary to Crooked Creek, and the removal of refuse. Streambank stability will be further enhanced once the native plantings become established. The sediment/retention basin, which was constructed prior to the implementation of this project, will promote additional sediment and nutrient removal from Crooked Creek before its confluence with Big Chapman Lake.

7.0 LITERATURE CITED

J.F. New and Associates, Inc. 2003. Chapman Lakes Engineering Feasibility Study. Walkerton, Indiana.

APPENDIX A.
Site Plan and Design Details



SITE MAP OF LOCATIONS 1 AND 2

Crooked Creek Bank Stabilization

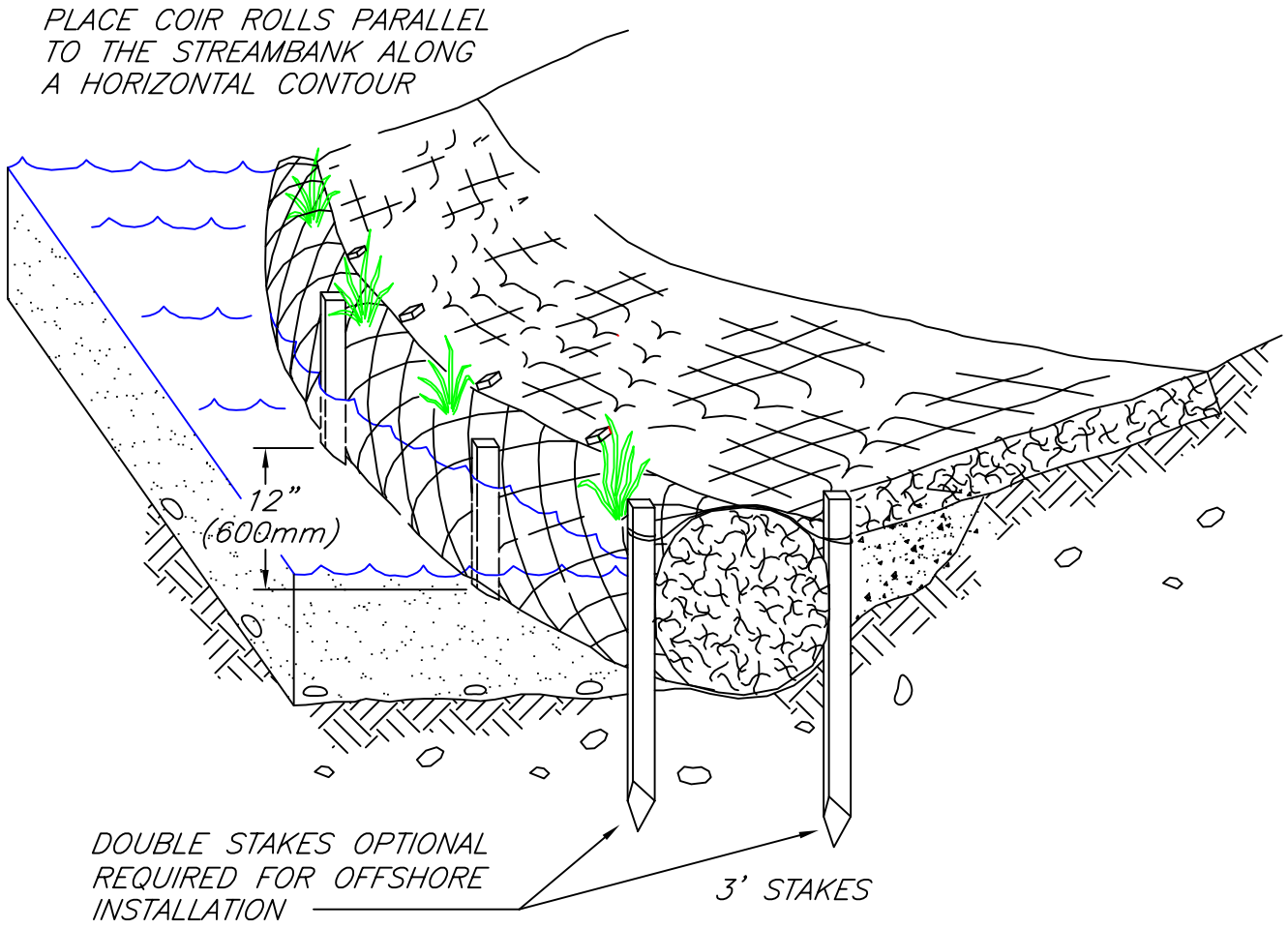
JFNew

DRAWN BY:	BRM
DESIGNED BY:	JR
CHECKED BY:	
DATE:	11/2002
JOB NO:	99-04-01
SCALE:	Not to Scale

Table A. Treatment list. Stations 1-30 are located on Crooked Creek (Site Location 2). Station 1 is located directly upstream of existing sediment basin. Stations 31-35 are located on the unnamed tributary (Site Location 1).

Station	Treatment	Streambank	Length (ft)
1	Cribwall/ Biolog	Right	60
2	Biolog	Left	20
3	Biolog	Right	50
4	Debris dam removed	Left	30
5	Cribwall/ Biolog	Right	40
6	Cribwall	Right	5
7	Cribwall	Left	65
8	Cribwall/ Lift	Right	50
9	Cribwall	Left	50
10	Cribwall	Right	70
11	Biolog	Right	30
12	Cribwall	Left	65
13	Cribwall	Right	30
14	Wing Deflector	Right	50
15	Wing Deflector	Right	50
16	Wing Deflector	Right	50
17	Cribwall	Right	90
18	Cribwall	Left	45
19	Biolog	Left	20
20	Cribwall	Right	120
21	Cribwall	Left	60
22	Cribwall/ Biolog	Right	30
23	Cribwall	Left	25
24	Biolog	Right	30
25	Cribwall	Left	105
26	Biolog	Right	40
27	Cribwall	Right	30
28	Cribwall	Left	50
29	Cribwall	Left	75
30	Cribwall	Right	35
31	Check Dam	Channel	12
32	Check Dam	Channel	12
33	Check Dam	Channel	12
34	Check Dam	Channel	12
35	Check Dam	Channel	12
		Total	**1,530**

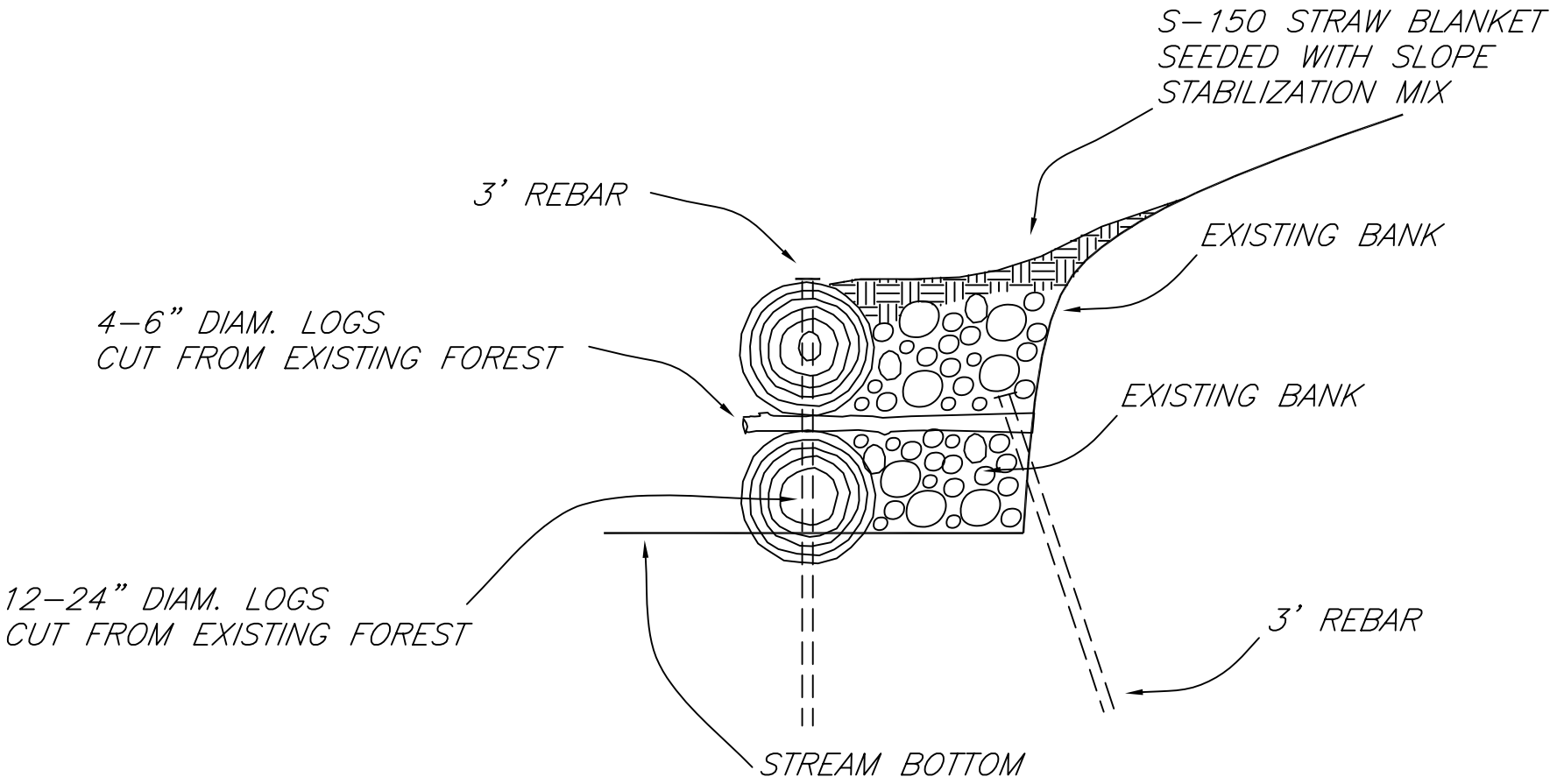
Right streambank = right streambank if looking upstream
Left streambank = left streambank if looking upstream
Channel = entire width of stream channel (bank to bank)



Typical Coir Log (Biolog) Treatment
Crooked Creek Bank Stabilization

JFNew

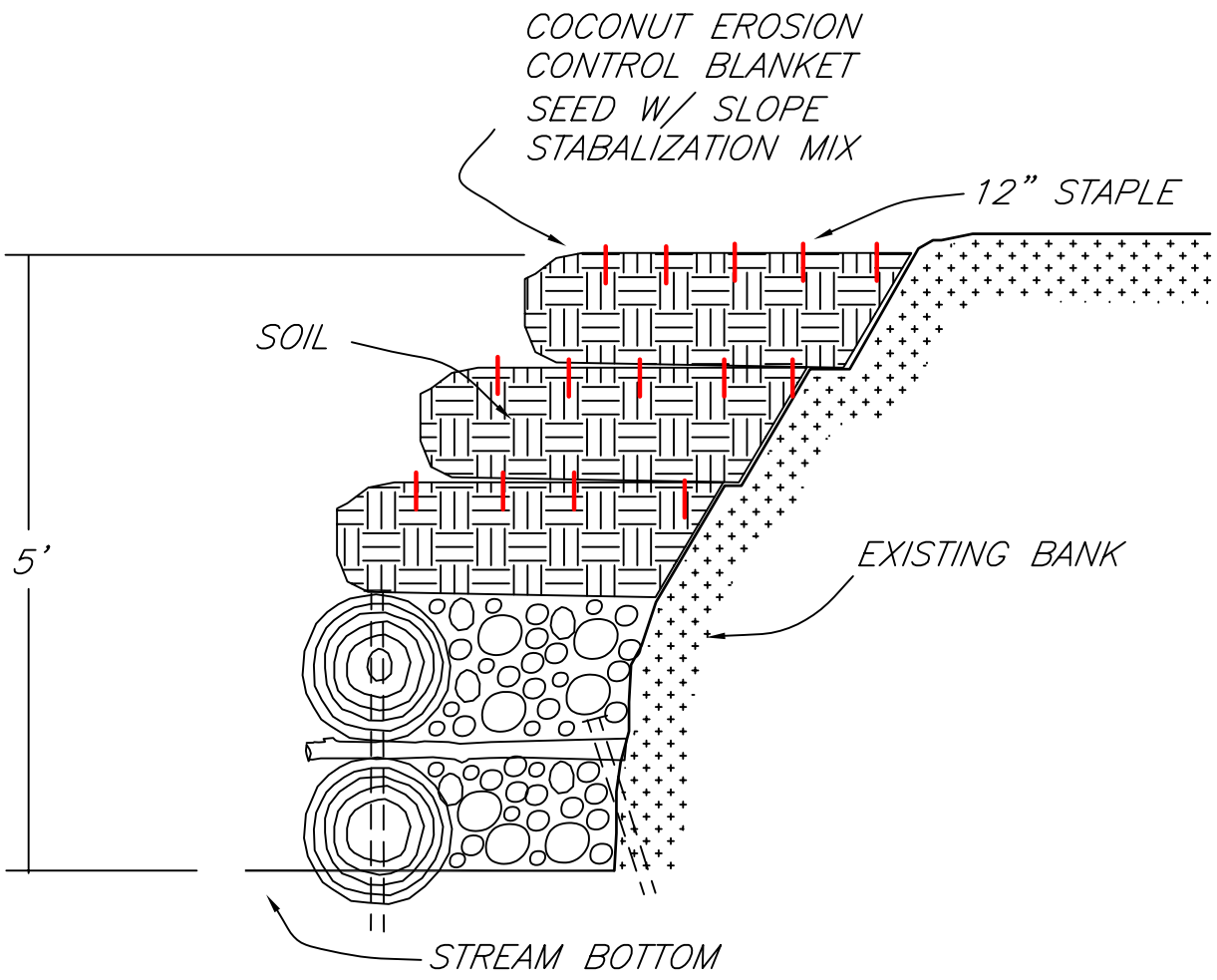
DRAWN BY:	BioDraw
DESIGNED BY:	
CHECKED BY:	
DATE:	11/2002
JOB NO:	99-04-01
SCALE:	NONE



Typical Log Cribwall Treatment
Crooked Creek Bank Stabilization

JFNew

DRAWN BY:	BioDraw
DESIGNED BY:	
CHECKED BY:	
DATE:	11/2002
JOB NO:	99–04–01
SCALE:	NONE



Typical Log Cribwall/ Soil Encapsulated LiftTreatment
Crooked Creek Bank Stabilization

JFNew

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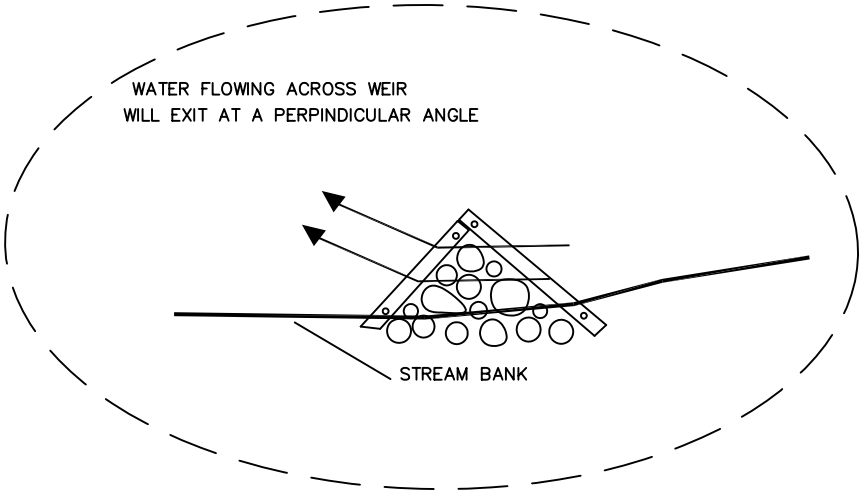
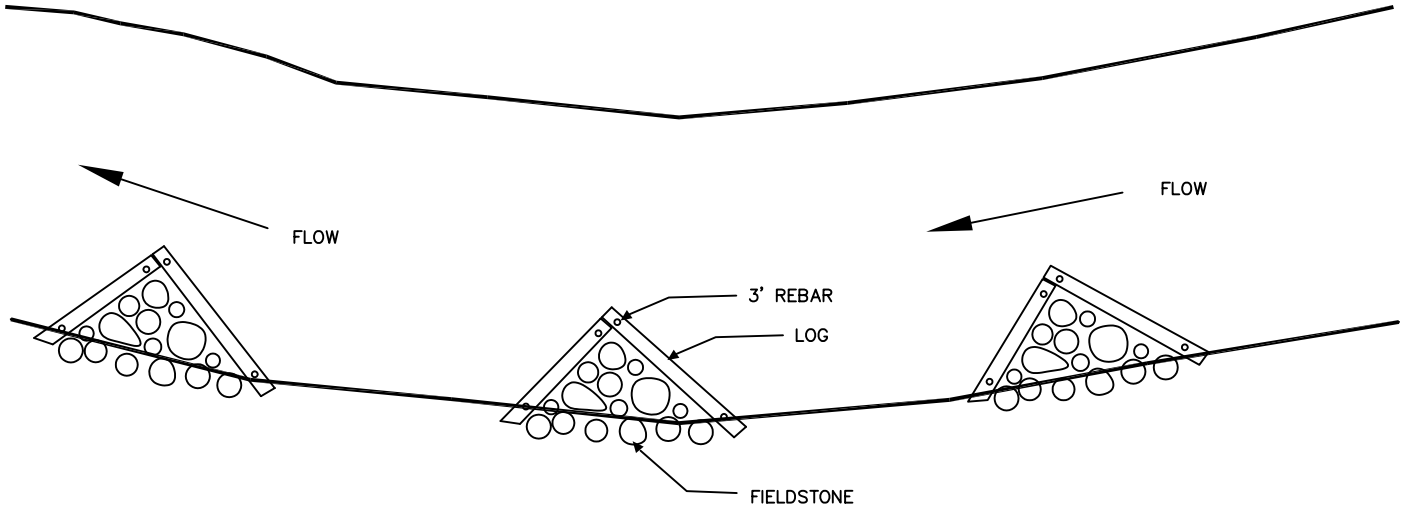
DESIGNED BY:	
CHECKED BY:	
DATE:	11/2002
JOB NO:	99-04-01
SCALE:	NONE

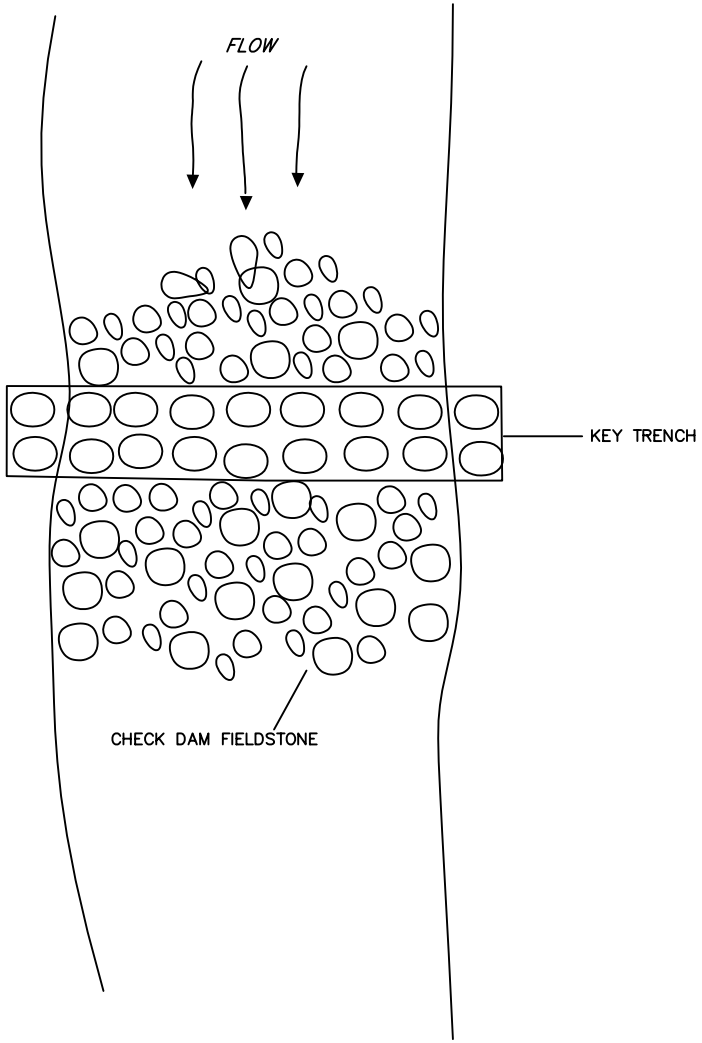




Typical Wing Deflector Treatment
Crooked Creek Bank Stabilization

JFNew

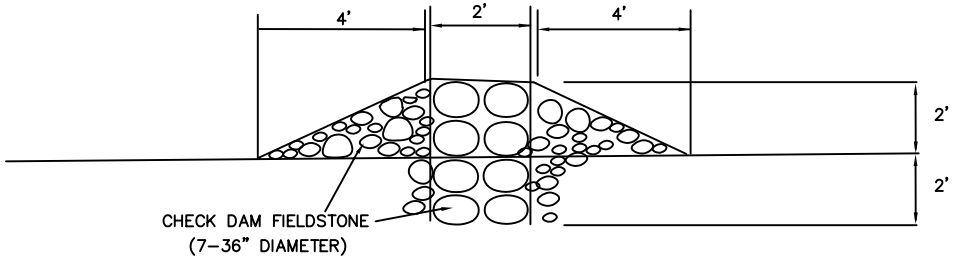
DRAWN BY:	BRM
DESIGNED BY:	JR
CHECKED BY:	
DATE:	11/2002
JOB NO:	99-04-01
SCALE:	NONE



CHECK DAM DETAIL

PLAN VIEW

NOT TO SCALE



CHECK DAM DETAIL

SIDE VIEW

NOT TO SCALE

Typical Check Dam For Site Location 1

Crooked Creek Bank Stabilization

JFNew

DRAWN BY:	BRM
DESIGNED BY:	JR
CHECKED BY:	
DATE:	11/2002
JOB NO:	99–04–01
SCALE:	NONE

APPENDIX B.
Permit Letters

Permit letters from the U.S. Army Corps of Engineers and Indiana Department of Environmental Management are not included in this portable document file. Please contact Dan Lee of the Chapman Lakes Foundation or John Richardson at JFNew for copies of these letters.

APPENDIX C.
Planting List

Native seed mix used to plant disturbed areas.

Scientific Name	Common Name	Amount (oz.)
Acorus calamus	Sweet flag	0.56
Actinomeris alternifolia	Wingstem	1.88
Agrimonia parviflora	Swamp agrimony	1.50
Agrostis alba	Red top grass	6.00
Agrostis alba palustris	Creeping bent grass	1.50
Angelica atropupurea	Great angelica	1.88
Asclepias incarnata	Swamp milkweed	1.50
Aster sp.	Aster	0.53
Avena sativa	Seed oats	270.00
Carex crinita	Fringed sedge	3.00
Carex grayi	Common bur sedge	0.39
Carex lupulina	Common hop sedge	1.50
Carex sp.	Carex	0.38
Carex stipata	Common fox sedge	0.50
Carex tribuloides	Awl-fruit oval sedge	0.77
Elymus riparius	Riverbank wild rye	6.00
Elymus virginicus	Virginia wild rye	6.00
Eupatorium maculatum	Spotted joe-pye weed	2.35
Helenium autumnale	Sneezeweed	1.50
Heracleum maximum	Cow parsnip	1.50
Hystrix patula	Bottlebrush grass	6.00
Lobelia siphilitica	Great blue lobelia	0.19
Lolium multiflorum	Annual rye	75.00
Mimulus ringens	Monkey flower	0.75
Rudbeckia laciniata	Wild golden glow	1.89
Scirpus atrovirens	Dark green rush	2.30
Spartina pectinata	Prarie cord grass	14.40
Thalictrum dasycarpum	Purple meadow rue	1.47
Veronia fasciculata	Common ironweed	1.50
Zizia aurea	Golden alexanders	1.57
	Total	414.31

Native plants used to plug biologs and disturbed areas.

Scientific Name	Common Name	Quantity
Calamagrostis canadensis	Blue joint grass	76
Carex crinita	Fringed sedge	76
Carex lurida	Bottlebrush sedge	76
Carex projecta	Loose-headed oval sedge	76
Carex tribuloides	Awl-fruit oval sedge	76
Chelone glabra	Turtlehead	76
Cinna arundinacea	Common wood reed	76
Elymus riparius	Riverbank wild rye	76
Helenium autumnale	Sneezeweed	76
Hibiscus palustris	Swamp rose mallow	76
Iris virginica shrevei	Blue flag	76
Rudbeckia laciniata	Wild golden glow	76
	Total	912